

CLAIMS

1. A process for producing a zeolite substance having an MWW structure, comprising the following first to fourth steps:

5 First Step:

a step of heating a mixture containing a template compound, a compound containing a Group 13 element of the periodic table, a silicon-containing compound and water to obtain a precursor (A);

10 Second Step:

a step of acid-treating the precursor (A) obtained in the first step;

Third Step:

15 a step of heating the acid-treated precursor (A) obtained in the second step together with a mixture containing a template compound and water to obtain a precursor (B); and

Fourth Step:

20 a step of calcining the precursor (B) obtained in the third step to obtain a zeolite substance.

2. The process for producing a zeolite substance according to claim 1, wherein the compound containing a Group 13 element of the periodic table used in the first step is a boron-containing compound.

25 3. The process for producing a zeolite substance according to claim 1 or 2, wherein the following first-2 step is performed between the first step and the second step, and the substance obtained in the first-2 step is used instead of the precursor (A) in the second step:

30 First-2 Step:

a step of calcining a part or entirety of the precursor (A) obtained in the first step.

35 4. The process for producing a zeolite substance according to any one of claims 1 to 3, wherein the following third-2 step is performed between the third step and the fourth step, and the substance obtained in the third-2 step is used instead of as the precursor (B)

in the fourth step:

Third-2 Step:

a step of acid-treating a part or entirety of the precursor (B) obtained in the third step.

5           5. The process for producing a zeolite substance according to any one of claims 1 to 4, wherein in the third step, a compound containing at least one element selected from the elements belonging to Groups 3 to 14 of the periodic table is present together with the acid-  
10       treated precursor (A) obtained in the second step.

6. The process for producing a zeolite substance according to any one of claims 1 to 5, wherein the template compound is a nitrogen-containing compound.

7. The process for producing a zeolite substance  
15       according to claim 6, wherein the nitrogen-containing compound is an amine and/or quaternary ammonium compound.

8. The process for producing a zeolite substance according to claim 6, wherein the nitrogen-containing compound is at least one member selected from the group consisting of piperidine, hexamethyleneimine and a  
20       mixture of piperidine and hexamethyleneimine.

9. The process for producing a zeolite substance according to any one of claims 2 to 8, wherein the boron-containing compound is at least one member selected from  
25       the group consisting of boric acid, borate, boron oxide, boron halide and trialkylborons.

10. The process for producing a zeolite substance according to any one of claims 1 to 9, wherein the silicon-containing compound is at least one member  
30       selected from the group consisting of silicic acid, silicate, silicon oxide, silicon halide, fumed silicas, tetraalkyl ortho-silicates and colloidal silica.

11. The process for producing a zeolite substance according to any one of claims 2 to 10, wherein the ratio  
35       between boron and silicon in the mixture of the first step is boron : silicon = 0.01 to 10 : 1 in terms of the molar ratio.

12. The process for producing a zeolite substance according to any one of claims 2 to 11, wherein the ratio between boron and silicon in the mixture of the first step is boron : silicon = 0.05 to 5 : 1 in terms of the molar ratio.

13. The process for producing a zeolite substance according to any one of claims 1 to 12, wherein the ratio between water and silicon in the mixture of the first step is water : silicon = 5 to 200 : 1 in terms of the molar ratio.

14. The process for producing a zeolite substance according to any one of claims 1 to 13, wherein the ratio between the template compound and silicon in the mixture of the first step is template compound : silicon = 0.1 to 5 : 1 in terms of the molar ratio.

15. The process for producing a zeolite substance according to any one of claims 1 to 14, wherein the heating temperature in the first step is from 110 to 200°C.

16. The process for producing a zeolite substance according to any one of claims 1 to 15, wherein the acid used for the acid-treated in the second step is a nitric acid.

17. The process for producing a zeolite substance according to any one of claims 1 to 16, wherein the heating temperature in the third step is from 110 to 200°C.

18. The process for producing a zeolite substance according to any one of claims 1 to 17, wherein the calcining temperature in the fourth step is from 200 to 700°C.

19. The process for producing a zeolite substance according to any one of claims 3 to 18, wherein the calcining temperature in the first-2 step is from 200 to 700°C.

20. The process for producing a zeolite substance according to any one of claims 1 to 19, wherein in the

third step, the acid-treated precursor (A) obtained in the second step and the mixture containing a template compound and water are previously mixed and then heated.

21. The process for producing a zeolite substance according to any one of claims 1 to 20, wherein a dry gel method of charging the acid-treated precursor (A) obtained in the second step and the mixture containing a template compound and water while isolating the precursor (A) and the mixture from each other, and contacting the vapor of the mixture containing a template compound and water with a mixture of a compound containing at least one element selected from Group 3 to Group 14 elements of the periodic table, and the precursor (A), in the third step.

22. A precursor obtained in the third step of the process according to any one of claims 1-21.

23. The precursor according to claim 22 which has a layered structure.

24. The process for producing a zeolite substance according to any one of 5 to 21, wherein the at least one element selected from the elements belonging to Groups 3 to 14 of the periodic table is at least one element selected from the group consisting of titanium, zirconium, vanadium, niobium, tantalum, chromium, molybdenum, tungsten, manganese, iron, cobalt, nickel, zinc, gallium, indium, tin and lead.

25. A metasilicate substance having an MWW structure containing at least one element selected from the elements belonging to Groups 3 to 14, in the Period 4 or more of the periodic table.

26. A metasilicate substance having an MWW structure containing at least one element selected from the elements belonging to Groups 3 to 14, in the Period 5 or more of the periodic table.

27. A metasilicate substance having an MWW structure containing at least one element selected from the group consisting of titanium, zirconium, vanadium,

niobium, tantalum, chromium, molybdenum, tungsten, manganese, iron, cobalt, nickel, zinc, gallium, indium, tin and lead.

28. A metallocsilicate substance for a zeolite  
5 substance having an MWW structure produced by the process according to any one of claims 1-21 and 24.

29. A layered precursor metallocsilicate substance  
for a zeolite substance having an MWW structure  
containing at least one element selected from the  
10 elements belonging to Groups 3 to 14, in the Period 4 or more of the periodic table.

30. A layered precursor metallocsilicate substance  
for a zeolite substance having an MWW structure  
containing at least one element selected from the  
15 elements belonging to Groups 3 to 14, in the Period 5 or more of the periodic table.

31. A layered precursor metallocsilicate substance  
for a zeolite substance having an MWW structure  
containing at least one element selected from the group  
20 consisting of titanium, zirconium, vanadium, niobium, tantalum, chromium, molybdenum, tungsten, manganese, iron, cobalt, nickel, zinc, gallium, indium, tin and lead.

32. A layered precursor metallocsilicate substance  
25 for a zeolite substance having an MWW structure produced by the process according to any one of claims 1-21 and 24.

33. A zeolite substance produced by the process according to any one of claims 1-21 and 24.

30 34. A process for producing a layered precursor for a zeolite substance, comprising the following first to third steps:

First Step:

35 a step of heating a mixture containing a template compound, a compound containing a Group 13 element of the periodic table, a silicon-containing compound and water to obtain a precursor (A);

Second Step:

a step of acid-treating the precursor (A) obtained in the first step;

Third Step:

5 a step of heating the acid-treated precursor (A) obtained in the second step together with a mixture containing a template compound and water to obtain a layered precursor.

10 35. A layered precursor for a zeolite substance, produced by the process according to claim 34.